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I·M3 Institute of Materials, Minerals & Mining

Interdisciplinary Science Reviews
2024, Vol. 49(3-4) 410–423
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DOI: 10.1177/03080188241233121
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1990s dinomania: Public and popular cultures of palaeontology from *Jurassic Park* to *Friends*

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Abstract

In the 1990s, the English-speaking world was swept up in a deluge of popular cultural content on palaeontology. Dinosaurs were featured in programming ranging from B-movie horrors to children's cartoon franchises to popular novels. In some ways, this widespread public interest in palaeontology was mirroring broader public and scientific conflicts such as the Alverez hypothesis, the 'birds are dinosaurs' debate, ownership rights over dinosaur fossils, intelligent design and creationism in schools, and major DNA sequencing projects. But in other ways, this popular culture material existed beyond these specific debates, and speaks to the ways that depictions of palaeontology fostered public understanding of science in this period. Perhaps no two depictions of palaeontology frame different, and in some ways conflicting, aspects of the field better than two of the biggest popular culture phenomena of the 1990s: *Jurassic Park* and *Friends*. *Jurassic Park*, for which we are approaching the 30th anniversary of its initial release, spawned two sequels within a decade, and three more since then. The heroes of the original movie were two palaeontologists, Alan Grant (Sam Neill) and Ellie Sattler (Laura Dern). *Friends,* which aired 1994-2004, was certainly the most successful sitcom of the period and one of the most popular television shows of all time. One of the six main characters, Ross Geller (David Schwimmer), is a palaeontologist, who at the beginning of the series works for the American Museum of Natural History and by the show's conclusion, has received tenure at New York University. The depiction of palaeontology in these two programs could not be more different. Drs. Grant and Sattler are competent action heroes, whose expertise regarding dinosaur morphology and behaviour are central to both their survival and their identity. Notably, the filmmakers for *Jurassic Park* centred the science of palaeontology in its story, working close with palaeontologist Jack Horner. They were also helped by the fact that their source material, Michael Crichton's 1990 novel of the same name, closely engages with scientific ideas and ethics. For Ross Geller on the other hand, his career as a palaeontologist is only on the outskirts of the TV series. Viewers occasionally saw Ross in professional settings (the classroom, the museum, a conference, a fellowship interview),

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but are not provided with enough information to even determine what sort of research he even does. The focus is always on his personal life; his interest in dinosaurs is just one aspect of his personality, one that does not even get mentioned in many episodes. It thus offers an unusual representation of scientists and science as fully integrated into society and the lived experiences of non-scientists. The palaeoscience occurs off-screen as a facet of the character rather than their defining characteristic. In this article, the authors will situate *Friends* and *Jurassic Park* within the dinosaur-mania of the 1990s, while analysing the different versions of palaeontological study that they projected to the public. It will draw connections between how palaeontology was depicted on-screen to the major real-life debates and discoveries in the field at the same time.

Keywords
film, palaeontology, pop culture, dinosaurs, extinction

Received 18 December 2023; accepted 26 January 2024

In the 1990s, the world was swept up in a deluge of popular cultural content on palaeontology. Dinosaurs were featured in programming ranging from B-movie horror to children's cartoon franchises to popular novels; it was dinomania. This widespread public interest in palaeontology mirrored broader public and scientific conflicts such as mass extinction causes, the 'birds are dinosaurs' debate, ownership rights over dinosaur fossils, intelligent design and creationism in schools, and major DNA sequencing projects. But in other ways, this popular culture material existed beyond these specific debates, and speaks to the ways that depictions of palaeontology fostered public understanding of science in this period.

New debates in palaeoscience led to the emergence of many academic positions that were considered heterodox. For instance, the Alvarez hypothesis seemed to betray the standard philosophies underpinning geological study since the nineteenth century. Robert Bakker, a major figure in the late twentieth-century palaeontological community, found his influence and expertise tipping into pop culture. The convergence of major popular interest in palaeoscience, alongside substantial and even bitter debates within the scientific field, meant that ideas considered heterodox within the scientific community, could receive a wider audience through the slew of popular science writing, film, television programming and novels published on dinosaurs in this period.

Different, and in some ways conflicting, portrayals of palaeontology were best depicted by two of the biggest popular culture phenomena of the 1990s: *Jurassic Park* (1993) and *Friends* (1994–2004). Directed by Steven Spielberg, *Jurassic Park* spawned two sequels within a decade, and three more since then. The heroes of the film are palaeontologist Alan Grant (Sam Neill) and palaeobotanist Ellie Sattler (Laura Dern). *Friends* was the most successful sitcom of the period and one of the most popular television shows of all time. A central character, Ross Geller (David Schwimmer), was a palaeontologist, who at the beginning of the series worked for a natural history museum and by the show's conclusion, was a tenured faculty member at New York University.

The depictions of palaeontology in these two programs were extremely different. Drs Grant and Sattler were action heroes, with expertise regarding dinosaur morphology and behaviour central to both their survival and their identity. Notably, *Jurassic Park* centred its story around the science of palaeontology with the filmmakers working closely with real-life palaeontologist John R. 'Jack' Horner to do so. Their source material, Michael Crichton's 1990 novel of the same name, also closely engaged with scientific ideas and ethics. On the other hand, in *Friends*, Ross Geller's career as a palaeontologist was only on the margins of the series. Viewers occasionally saw Ross in professional settings (e.g. the

classroom, the museum, a conference, a fellowship interview), but were not provided with enough information to even determine the specifics of his work. In fact, the other characters pay little attention to his work, teasing him for his 'nerdy' interests. Nearly whenever the other characters bring up science, it seems to be in a manner which is intended to insult Ross. There is some irony in the fact that Ross's interest in dinosaurs codes him as 'nerdy' compared to his friends, right at a time when palaeontology was at peak cultural popularity, embodied in the action star personas of Grant/Neill and Sattler/Dern. The palaeoscience occurred off-screen as a facet of the character, rather than his defining characteristic. The focus was always on his personal life; his interest in dinosaurs was just one aspect of his personality, one that did not even get mentioned in many episodes. *Friends* thus offered a heterodox representation of scientists and science as fully integrated into society and the lived experiences of non-scientists.

In this article, we situate *Friends* and *Jurassic Park* within the dinomania of the 1990s, while analysing the heterodox versions of palaeontological study that they projected to the public, through drastically different approaches. It will draw connections between the palaeontology that was depicted on-screen and major real-life debates and discoveries in the field that were occurring at the same time, demonstrating that each vehicle took positions in what were, at the time, the ultimately winning sides of major palaeontological debates.

The dinosaur renaissance in science and pop cultures

The 'dinosaur renaissance', a phrase coined by palaeontologist Robert T. Bakker (1975), refers to the period beginning in the late 1960s and extending to the end of the 1990s, when new discoveries in geology and palaeontology renewed scientific and popular interest in dinosaurs, revitalising their image from that of cold-blooded, sluggish 'terrible lizard' to active and warm-blooded animals whose descendants live among us as birds. In 1993, prominent palaeontologist and science writer Stephen Jay Gould commented that 'popular acclaim of dinosaurs has been fitful and episodic…. During the last twenty years however, dinosaurs have vaulted to a steady level of cultural pervasive popularity' (2002, 172). So pervasive was the dinosaur popular culture saturation that Michael Crichton was hesitant to write about dinosaurs when first struck with inspiration:

> I resisted it at first. At the time there was a great dinosaur mania in this country; and I felt that if I did something on dinosaurs, it would be seen as part of a trend. I didn't want that association, so I decided to wait. But the next year there was still a dinosaur mania and the year after that it was *still* going strong, so finally I realized it was always going to be here. (quoted in Shay 1993, 3)

Little did he know that *Jurassic Park* would become *the* dinosaur book at the peak of dinomania that would cyclically lead to a revival of popularity of the genre of books he feared his work would be criticised as emulating.

The popularity of this film and its source novel led to the reissue of a series of dinofictions first published in the 1980s. John Brosnan's *Carnosaur* (1984) was adapted into a series of Roger Corman-produced B-Movies of the same name (1993, 1994, 1995), which along with the release of *Jurassic Park* helped to revive interest in the dino-fiction genre with Geoffrey T. Williams's *Dinosaur World* (1985) and *Lost in Dinosaur World* (1987), and Bakker's own *Raptor Red* (1995) all taking spots in the best-sellers' lists during the early 1990s. Notably, *Jurassic Park* was not Spielberg's first foray into the prehistoric era, having produced the first film from the 14-film franchise *The Land Before Time* (1988). This animation was part of a plethora of dinosaur-focused family/children's media featuring dinosaur characters, which ranged from the anthropomorphic *Dinosaurs* (1991–1995) to the remake of *Land of the Lost* (1991–1992) to the long-running *Barney and Friends* (1992–2010; 2023–). *Jurassic Park* positioned scientific

believability and authenticity at its centre and remodelled the popular imagination of the dinosaur, setting it apart from the rampant, almost actively un-scientific, dinomania that surrounded it.

The first models of dinosaurs, still residents of London's Crystal Palace, were made by natural history sculptor Benjamin Waterhouse Hawkins. Unveiled to the public in 1854, they came under the direction of the controversial but influential palaeontologist Richard Owen. Largely due to Owen's influence, these 'pachydermal reptilians' came to reflect how dinosaurs were imagined (Tattersdill 2017, 1). Dinosaurs were moulded into 'degenerates stuck in an evolutionary dead end and bound for extinction' (Lamb 2018, 55), an image that was not fully overturned in palaeontology until the 'dinosaur renaissance'. *Jurassic Park*'s animatronic dinosaurs re-sculpted the public imagination, turning a variety of dinosaurs into pop culture stars. Fifteen species appear in the novel including the *Tyrannosaurus Rex* (T. rex), *Velociraptor* and *Triceratops*, and less well-known types like the *Procompsognathus* and *Dilophosaurus*. The majority of the species detailed in the book and later appearing in the film lived in the Cretaceous period. Several dinosaurs were 'reinvented by this renaissance' including the T. rex (Lamb 2018, 55), which meant that museums began to reposition their collections' skeletons that were previously forced into unnatural poses with their tails on the ground that replicated eventually disproven assumptions about dinosaurs that dated back to the nineteenth century. Most famously the T. rex at from the American Museum of Natural History (AMNH, specimen 5027), mounted in 1915, pinned the dinosaur's tail to the ground creating a 'tail-dragging pose' that began drawing criticism in the 1970s for its inaccuracy (Ross, Duggan-Haas and Allmon 2013, 148). The display was eventually taken down in 1992 in the wake of the *Jurassic Park* novel and in anticipation of the forthcoming film and then re-postured for display in the revamped dinosaur halls that opened in 1994.

Jurassic Park represented the changes and complexities in the specific debates of palaeontological science but can also give us insight into the intricacies of putting science into entertainment media more generally. It collapsed 'distinctions between fact and fiction, life and art, science and entertainment' through its stance on contemporary debates and the development of technologies to make the dinosaurs as 'real' as possible (Franklin 2000, 215). Despite the positioning of the film by marketing materials as 'based on actual, ongoing genetic and paleontologic [sic] research' ('Welcome to *Jurassic Park*' [Anon 1992, 2]), in the sequel, *The Lost World* (1997), Spielberg rejected Jack Horner's, the franchise's main science consultant, advice to have colourful dinosaurs, which Bakker believed were the norm (Bakker 1986, 286–289). Instead, the filmmakers chose to retain the established neutral tones and lizard-like appearance, perhaps making them *more* believable to the general intended audience. Spielberg worried that smaller, more colourful dinosaurs 'wouldn't be scary enough' (Mottram 2021, 24), but it might have also been a step too far away from previously accepted dinosaur imagery and would perhaps distract his audience from the adventure story. The decision to adapt the dinosaurs for screen as less-than scientifically accurate continues to affect the popular image of dinosaurs, and a choice that also impacted the more recent (post-2015) reanimation of the franchise that also ignored parts of that aforementioned 'ongoing' research into dinosaur physiology. As lead Biosyn geneticist Dr Henry Wu (BD Wong) explains in *Jurassic World* (2015) the dinosaurs are not entirely accurate but a merging of scientific reality and desired imaginaries, saying:

> You are acting like we are engaged in some kind of mad science. But we are doing what we have done from the beginning. Nothing in Jurassic World is natural. We have always filled gaps in the genome with the DNA of other animals. And, if their genetic code was pure, many of them would look quite different. But you didn't ask for reality. You asked for more teeth!

The *Jurassic World* films had to balance making the dinosaurs align with the established rules of the original *Jurassic Park* storyworld (the canon) and with the expectations of potential new audiences that

presumed that the franchise would remain up-to-date and incorporate accurate feathery brightly-coloured dinosaurs. *Jurassic Park* and its sequels were never meant as forms of palaeontology science education, but part of what made the first film so impactful was that sheen of scientific accuracy that made you think that this could *maybe* happen.

Jurassic Park and scientific debates

Jurassic Park took the dinosaurs of earth's distant past and placed them in a science-fictional present layered with adventure, family drama, and horror. It sparked a 'dinosaur renaissance' in popular culture (Kirby 2011, 127) that changed perceptions of dinosaurs from sluggish dim-witted beasts of the 'B.C. (before Crichton) age' into fast intelligent predators (Willman 1993). Crichton was a Harvard-educated (anthropology and medicine) author who 'made a name for himself by laundering an impressive amount of expertise into blockbuster pulp fiction' (Radin 2019*a*, 412). Many of his narratives have been and continue to be adapted and offer audiences fictions that explore controversial and often emergent uses of science and technology. Spielberg's film adaptation of *Jurassic Park* expanded the public understanding of DNA, genetic engineering, and the palaeo-scientific knowledge of non-expert audiences by not only showing science but also engaging with emergent scientific debates.

Jurassic Park came down on the side of the 'birds are dinosaurs' not cold-blooded lizards debate, an approach led by then-controversial palaeontologists Bakker and Horner. Proudly branded 'the dinosaur heretic' (Monmaney 1993), a moniker drawn from the title of his 1986 book, Bakker was a scruffy cowboy-hat-wearing palaeontologist who argued that the dinosaurs were warm-blooded, cunning, and socially complex and that 'the dinosaurs never died out completely. One group still lives. We call them birds' (1975, 58). Crichton (1990, 85) referenced this work directly and Bakker's proposed updates to the visualisation of dinosaurs impacted the production design that saw *Jurassic Park* shift away from the creature features that came before it. The new film represented a terrifying presentation of intelligent animals able to plan, manipulate, and stalk prey. This was a transformation of a classic movie monster into an animal, like those found on safari or in popular nature documentaries that deserved the respect of humans (Baird 1998). But, as David A. Kirby (2011, 127) notes, *Jurassic Park* 'contains conjectures' about dinosaurs that were and still are 'open questions in the field of palaeontology'. As a speculative science fiction film that imagined the dangers of unrestricted science and scientists who 'were so preoccupied with whether they could, they didn't stop to think if they should' (Ian Malcom [Jeff Goldblum]), *Jurassic Park* stretched 'the bounds of reality' in terms of what advances in science could achieve (Radin 2019*b*, 310), but it also presented a logical argument for a revision of the dinosaur that took hold of the public imagination, including theories that positioned dinosaurs as the evolutionary ancestors to contemporary bird species. As the most prominent critic of the 'dinosaur-bird link', Alan Feduccia, vociferously critiqued the theropod hypothesis that underpinned *Jurassic Park* and Grant's adventurous scientific perspective. Feduccia repeatedly and explicitly argued that 'the dinosaurian origin of birds is… a delusional fantasy' (quoted in Monastersky 1997, 120). The dinosaur renaissance and its associated theories that *Jurassic Park* presents as logical and even recognised facts were at the time rather controversial claims that were not yet widely accepted.

Scientific verisimilitude is woven into the introduction of the *Jurassic Park* theme park as the scientists invited to preview it – Ellie Sattler, Alan Grant and Ian Malcom – review an animation that will play in the visitors' centre. The welcome video fills the screen, replicating the view of the scientists and introducing Mr. D.N.A. (Greg Burson), an animated character, whose folksy accent gives him an approachable but knowledgeable frame to explain the cutting-edge genomic science. As Sarah Franklin (2000, 191) has argued, 'images and imaginations shape the directions of genetic science' due to the 'inextricability of the genome from its imagined future promises, hopes and dangers' represented in films like

Jurassic Park. The use of the cartoon character and welcome video to visualise and explain genetic science presents this emergent research as widely accepted knowledge that even children could understand. It offers a 'dual spectator thrill' on-screen that shows not only the dinosaurs but also the scientific spectacle of how it was achieved (Franklin 2000, 200). *Jurassic Park* was released three years into the Human Genome Project and advertised with the tagline 'a film that makes extinction a thing of the past', drawing upon public interest not only in emergent new genetic research but also the dinomania that had been growing since the late 1980s. The widespread diffusion of these ideas led to the rise of the 'celebrity science' of ancient DNA research (Jones 2022).

Jurassic Park's representation of new genetics and palaeontology works *with* – but also disrupts – public notions of 'established science' about dinosaurs and the possibilities of genetic engineering. It represents research as an intricate and ongoing practice; a reality that is sometimes overlooked as part of the communication of science in part because of uncertainty it suggests (Field and Powell 2001). Megan Stern (2004, 347) makes a distinction between professional 'real' 'science' and capital-S 'Science', the abstract concept often used in public discourse that can be parsed into narratives of good and bad science. Often, 'public understanding emerges as the site at which an ideal notion of good 'Science' emerges, against which the practices of actual scientists often appear inadequate' (Stern 2004, 348). As Hyman Field and Patricia Powell (2001, 423) explain:

> Since research is an ongoing process, often lacking definitive answers, it tends to generate controversy. The public needs to understand the positive role of controversy in shaping the research process rather than viewing it as an indication of poor science or befuddled scientists.

Jurassic Park takes a position on scientific debates surrounding palaeontology and advances in genetic engineering and presents science – in the filmic diegesis, the marketing and in scientific and cultural responses – as evolving. It also engages through discussions of ethics and chaos theory, indicating how science can be debated among scientists and complicated through the process of politicisation and commercialisation. *Jurassic Park* 'overtly responds to public anxieties concerning the commercial appropriation of science, whilst simultaneously representing the pleasures to be gained by consuming science' (Stern 2004, 348–349). This becomes another 'dual thrill' as audiences can join the critique of venture capitalist John Hammond (Richard Attenborough) whilst also buying into the world of the film created by roboticists, computer scientists and advances in cinema technology that resurrect and contain the dinosaurs in a way that Hammond cannot.

Science and scientists were woven into *Jurassic Park*'s development from genetics and palaeontology research conducted and embedded into book and film, to the animatronics, texture mapping and robotics used to bring the dinosaurs to life. Filmmakers read Horner's book *Digging Dinosaurs* (Horner and Gorman 1988) and Bakker's revolutionary 'Dinosaur Renaissance' article (1975) in preparation for *Jurassic Park* and the development of the character of lead palaeontologist Alan Grant. In the 1990 novel, Crichton directly drew a parallel between the real and fiction palaeontologists, noting that along with 'Jack Horner, Grant had been the first to describe the species' (206). Neill shadowed Horner in his preparation for his role in the film so that he could see 'what a palaeontologist is like' (Horner quoted in Kirby 2011, 71). A combination of the two real scientists (Kutner 2014), rather than the stereotypical version of a 'nerdy' scientist, Grant was a handsome Panama-hat-wearing adventurer who became the popular culture face of the science that reimagined the dinosaur. He notably also bore a resemblance to Harrison Ford's iconic fedora-hat-wearing academic action hero Indiana Jones, another Speilberg franchise that became part of the cycle of rebooting and remaking since its initial release. Picking a side in a scientific debate was a bold intervention for a Hollywood movie, one that reshaped public opinions on dinosaurs and opened debates around what dinosaurs were/

are to a much broader audience beyond the dig, the lab and the journal. However, this was by no means unusual in the period, as films that used 'genetic engineering as a plot element' such as *GATTACA* (1997), *Alien: Resurrection* (1997) and *Deep Blue Sea* (1999) were anticipating the technology and ethics around CRISPR (Kirby 2000, 193).

The relationship between science and cinema has changed gradually over the last thirty years since the release of *Jurassic Park*. Science is expected to be consistent and believable across all of our fictions (Kirby 2011). *Jurassic Park*'s release notably coincided with the emergence of the internet and the digital age where a 'lack of gatekeepers for this new medium meant that anybody could disseminate their ideas online about the blasphemous science of *Jurassic Park*' (Kirby and Chambers 2018, 293). *Jurassic Park* also entered public discussions of science through many more analogue routes. With such a broad range of corporate tie-ins there was a hope that the film could get 'a profile as high as T. rex' making the film synonymous with public understanding of palaeontology (Nichols 1994). A film is 'not a discrete entity' but part of a network of commodities with their own narratives and meanings beyond the 'borders' of the film itself (Balides 2000, 139). *Jurassic Park* was considered 'too scary' for younger audiences and yet generated a 'dinosaur sales blitz' with products aimed at that younger market through products from lunch boxes and clothing to action figures – many of which were copies of those featured in the film's theme park gift shop (Giles and Foote 1993, 64). *Jurassic Park*'s explicit 'commercial intertextuality' was part of the development of the film with the intention that it became a phenomenon with multiple 'sites of reception' that embedded it into popular culture broadly and across generations (Balides 2000, 142, 139). One such site of reception was another 1990s phenomena with 'sustained cultural currency' (Cobb, Ewen and Hamad 2018, 684): the decade-long series *Friends*. The show is a cultural touchstone that has remained popular thanks to extensive global distribution, syndication, and, most recently, streaming. *Friends* was selective about what real-world events it chose to acknowledge or even incorporate into the show-universe but there were several instances of engagements with cultural texts, including *Jurassic Park,* and the responses to and developments in palaeontological science through the life and work of Ross Geller.

Friends: The one with the palaeontologist

Ross Geller was one of the many people in the 1990s interested in both the 1993 blockbuster film *Jurassic Park* and palaeontology. On 22 September 1994, NBC debuted what would become one of the most popular television series of all time (Cobb, Ewen and Hamad 2018). Although the sitcom had an ensemble cast, the longest-running story of the series was an on-and-off again relationship between the characters of Rachel Green (Jennifer Aniston) and Ross. While not the primary focus of the series, Ross's profession as a palaeontologist was a recurring theme throughout.

Unsurprisingly, perhaps, as a palaeontologist working between 1994 and 2004, Ross was a fan of *Jurassic Park*. In season three, Ross and fashion-buyer Rachel argued over whose work is more boring, and Ross retorts 'You know what, 100 million people went to see a movie about what I do, I wonder how many people would go see a movie called, *Jurassic Parka*?' ('The One with Phoebe's Ex-Partner'). In season seven, he even argues that 'I had the idea for *Jurassic Park* first!' ('The One With Rachel's Book'). In season four, when Joey Tribbiani (Matt LeBlanc) incorrectly expounded 'And on your left, you have Tyrannosaurus Rex, a carnivore from the Jurassic period.' Ross corrected him: 'Uh actually Joey, it's the Cretaceous period,' a possible nod to the well-known incongruity (Gould 2002, 187) of the *Tyrannosaurus Rex* gracing the *Jurassic Park* logo ('The One With Phoebe's Uterus').

While typically not a figure associated with the 'dinosaur renaissance', Ross Geller is probably the most famous fictional palaeontologist. To scholars of science and technology, Ross's character is a fascinating one. In some ways, *Friends* is just one of the many cultural vehicles of the 1990s to introduce

fictional palaeontologists into American living rooms. However, unlike many other fictional scientists, Ross's career choice was not central to his identity. In the vast majority of entertainment media representations of scientists, 'the prototypical scientist' has an 'inconspicuous appearance [and] …very little is revealed of their private lives (Weingart, Muhl and Pansegrau 2003, 282). Ross may align to the traditional representation of scientists as white and male (Weingart et al. 2003), but far more attention was paid to his love life (Ewen 2018), even if his work and romantic interests did sometimes overlap. Over the course of the show, Ross dated two professional palaeontologists, Julie (Lauren Tom) and Charlie (Aisha Tyler); Cheryl (Rebecca Romijn), 'a palaeontology doctoral candidate, specializing in the Cenozoic era' ('The One with the Dirty Girl'); and Elizabeth (Alexandra Holden), an undergraduate from one of his own classes.

For the first five seasons Ross had only limited abilities to pursue his main interest in dinosaurs. At the (fictional) Museum of Prehistoric History, nearly all of the specific work he mentioned was related to the Pliocene and Pleistocene, well after the extinction of the dinosaurs. For example, he was responsible for dioramas involving, in his words, 'australopithecus', 'homo-habilis', 'homo-sapiens', 'cave people', 'mastodons' and 'proto-humans'. Ross only travelled to the field once, to negotiate his museum's acquisition of a new specimen. In season six he embarked on a new career trajectory when the (fictional) Palaeontology Department at New York University (NYU) offered Ross work as an adjunct lecturer. Ross's position at a real university that does not in actuality possess a palaeontological programme feeds audience expectations that all prestigious universities would include universal expertise. Indeed, most palaeontology programmes in the United States are not stand-alone departments, but housed within geology, earth science, or physical anthropology departments, nuances of academic organisation that could be lost on the public at large. Ross's affiliation is one that legibly converts him into a successful scientist. At the end of season nine, Ross was selected to give the keynote speech at a major conference. His speech, on the shortcomings of radiocarbon dating, in favour of CT and MRI scans and DNA analysis, which at the time put his work 'actually ahead of the curve… before CT scanning become a standard paleotool' (Hooten 2015), received a standing ovation ('The One in Barbados Part 2'). At the start of season ten, Ross became 'a finalist for a *huge* research grant' ('The One With Ross' Grant'). Eight episodes later, his 'tenure review board met today and I hear it's looking *really* good' ('The One With Princess Consuela'). By the end of the episode, Ross has received tenure at NYU.

Given how much Ross's career remained in the background for most of the episodes, it might seem surprising that, just like *Jurassic Park, Friends* also took stances on what were major debates in palaeontology at the time, beyond references to tools and techniques in the future of palaeontological research. For instance, through the 1980s and 1990s, the spellbound media watched a major debate rage through the field of palaeontology as scientists grappled with several possible causes for dinosaur extinctions (Glen 1994, 2). The Alvarez hypothesis, co-authored by father-son team Luis and Walter Alvarez, refers to the idea that the impact of a large asteroid, about 65 million years ago, led to the Cretaceous–Palaeogene (K–Pg) extinction event (Alvarez et al. 1980). They argued that a thin layer of iridium at the Cretaceous–Palaeogene boundary had extraterrestrial origins and was carried to Earth from a large 'piece of solar system debris' crashing into Earth (Alvarez 1987, 256).

While this idea, aptly co-developed by the former Manhattan Project particle physicist Luis Alvarez, fit within contemporary Cold War discussions of possible nuclear age extinctions (Sepkoski 2020), it was initially controversial. The prospect of a single extinction event fit squarely in the realm of catastrophism, the idea that the earth's landscape was formed by a series of brief catastrophic events, which had not been in vogue since the early nineteenth-century. Most twentieth-century geologists favoured uniformitarianism – slow gradual changes – the theory championed by Charles Lyell in his 1830 *Principles of Geology* (Gould 1965). Walter Alverez strongly believed that it was this commitment to uniformitarianism that hampered more widespread acceptance of the theory arguing that: 'it would be misleading to

represent the Cretaceous–Tertiary debate as always well-mannered and friendly. The ingrained uniformitarian foundation of geology and palaeontology was under assault' (Alvarez 1997, 84–85). Kenneth Hsu agreed, defending the hypothesis by asserting that

> as individuals of *Homo sapiens* with a collective memory of less than 10^4 years, we would be arrogant to follow Lyell and to assume that we have experienced all that is possible, when geology tells us that the rate and energy of natural processes have not remained uniform during the billions of years of geological time. (Hsu 1989, 753)

Further, advocates of the Alvarez hypothesis had yet to find evidence of an impact crater which would support their theory. The dinosaur heretic himself was sceptical of the Alvarez hypothesis, arguing that despite the 'glamour' of 'the hypotheses of death-dealing cosmic collisions… celestial collisions cannot be the chief culprits in the collapse of ecosystems' (Bakker 1986, 439).

In 1991, after Luis Alvarez's death and nearly a decade after the influential paper, geologists Alan Hildebrand and Glen Penfield identified the Chicxulub Crater on the Yucatán Peninsula as a possible site for an impact crater which 'may have caused the K/T extinctions' (Hildebrand et al. 1991, 871). The film *Jurassic Park* integrates this discovery into its text as well: young dinosaur enthusiast Tim Murphy (Joseph Mazzello) has 'heard that there was this meteor, [which] hit the earth someplace down in Mexico, and made this big crater' and 'they died because of the weather'. In 1997, Princeton University Press published Walter Alvarez's memoir of both the hypothesis and the subsequent identification of the Chicxulub Crater as the impact site, *T. Rex and the Crater of Doom,* one of the *New York Times* Notable Books for that year.

As a palaeontologist in this era, it is perhaps unsurprising that Ross engaged with this debate. In a season six episode, which aired in 2000, Ross was watching a television programme, the narrator of which declares that '[w]hen the Cretaceous period ended, the dinosaurs were gone.' Alluding to the debate over mass extinction, Ross wondered aloud 'What happened, you guys?,' before being interrupted ('The One with the Proposal Part 2').

In season nine Ross made his own position clear. While talking to a cashier who is 'fascinated by palaeontology', she asks 'Have you read the new Walter Alvarez book?' Ross responded enthusiastically 'Yeah! I-I teach it in my class.' ('The One with the Cooking Class'). Ross's stance was not made clear until this episode, which aired in 2003, rather than when the show first aired in 1994, when such a take was far more controversial. But it was not until 2010 that the palaeontology community reached a consensus on the Alvarez hypothesis (Schulte et al. 2010), with some holding out for more varied causes for the K–Pg extinction event (Archibald et al. 2010).

Beyond the exchange over *T. Rex and the Crater of Doom,* seasons nine and ten offered more indications that Ross was a supporter of the Alvarez hypothesis. Ross clearly had some recent successes: he was a finalist for a major grant, delivered the keynote address at a national conference, and moved from part-time adjunct work to being tenured at a top university within only a four-year period. In season nine, he bemoaned the fact that 'the last two papers I've written were widely discredited', though Phoebe Buffay (Lisa Kudrow) assures him that 'I thought your paper on punctuated equilibrium in the Devonian era was top notch!' ('The One With The Soap Opera Party'). In season ten, he rejoiced that he may be featured in 'the '*Palaeontology Review*'! Yeah! That'll be the first time my name is in there, without people raising serious questions about my work!' ('The One With Ross's Grant').

Ross's work on punctuated equilibrium is key. In the field of evolutionary biology, punctuated equilibrium is the theory that once a species appears in the fossil record, it will show little evolutionary change. When any significant evolutionary change occurs, it is restricted to rare and geologically rapid events of speciation. Originated by Niles Eldredge and Stephen Jay Gould, this theory contends

that gradual evolution is virtually non-existent in the fossil record. Instead, 'the history of evolution is not one of stately unfolding, but a story of homeostatic equilibria, disturbed only 'rarely'… by rapid and episodic events of speciation' (Eldredge and Gould 1972, 84). Not only did punctuated equilibrium represent a challenge to Darwin's theory of gradual evolution, but it also challenged uniformitarianism, suggesting that some unknown factor caused these interruptions to evolutionary stasis. One of the foremost popular science writers of the 1980s and 1990s, as well as a historian and philosopher of science in his own right, Gould's writing was widely consumed beyond the scientific community (Yoon 2002). He was an early and ardent supporter of the Alvarez hypothesis, calling it 'science at its grandest and most useful' (Gould 1985, 417). Gould even took a philosophical approach to the nature of this debate science. It was not that the hypothesis was necessarily the right one, but that it is the right direction for palaeontologists to move: 'Whatever the eventual outcome (I suspect it will be positive), the Alvarez hypothesis is exciting, fruitful science because it generates tests, provides us with things to do, and expands outward. We are having fun, battling back and forth, moving toward a resolution, and extending the hypothesis beyond its original scope' (Gould 1985, 425).

Gould's interest in the Alvarez hypothesis was not completely disinterested. Luis Alvarez concludes his autobiography with the practical reason Gould might have been an early supporter:

> I watch with pleasure as the distinguished Harvard palaeontologist Steve Gould runs interference for us. His theory of punctuated equilibrium holds that evolution proceeds by sudden jumps rather than the slow and steady progress that Darwin had in mind. Our impact theory is just what Steve needed to drive punctuated equilibrium: when species come into equilibrium, only a drastic change in the environment, wiping out most of the well adapted, makes major evolutionary change possible. (Alvarez 1987, 282)

Gould himself confessed a similar motivation:

> I, if I may toot my horn, was among [the] few initial supporters, but not for the right reason of better insight into the evidence. Catastrophic extinction simply matched my idiosyncratic preference for rapidity, born of the debate over punctuated equilibrium. After all, my colleagues had been supporting Darwinian gradualism for a century. (Gould 1995, 152)

Just like Gould, Ross's published research on punctuated equilibrium indicates that he too was a supporter of the Alvarez hypothesis.

In general, there was little consistency in the construction of Ross's relationship to science across the series; the more science-focused episodes generally did not share writers. But the show's writers foray into mass extinction were not the show's only engagement with headlines over scientific controversies. For instance, in a key episode regarding *Friends*'s interrelations with heterodox palaeontology, season two alluded to the creation science/intelligent design educational controversies of the era (Larson 2003), via an episode-long debate between Ross and Phoebe over the validity of evolution ('The One Where Heckles Dies'). Ross was also shown working on subjects beyond dinosaurs; his work on ancient pre-humans at the museum as an exhibition curator also permitted a nod to contemporaneous research in anthropology, with the specimens 'Lucy', discovered in 1974 and 'Ardi' in 1994 resulting in a global race to identify the oldest pre-human remains (Pattison 2021). Ross's research as a narrative tool within the show for connecting to discussions of science and the distant past – well beyond the lives of the New Yorkers of *Friends* – may have been too broad for a researcher working at his supposed level, but it did permit the show to incorporate an intriguing number of contemporary debates, many of which aligned with 1990s dinomania and the dinosaur renaissance.

Conclusions: Projecting palaeontology pasts and present

Although Crichton indicated that he had been initially reluctant to write a book about dinosaurs when he did, his work has remained incredibly resilient. He composed a sequel to *Jurassic Park, The Lost World* (1995), which was adapted into a feature film in 1997, also directed by Spielberg. A third film was released in 2001, with largely an original screenplay. In 2015, capitalising on Millennial and Gen-X nostalgia (Loock 2020), the *Jurassic Park* franchise was rebooted in 2015, with the release of *Jurassic World* (2015) which was followed up with sequels in 2018 and 2022. Crichton's estate, in the meantime, posthumously published *Dragon Teeth* in 2017, which Crichton had left unpublished in 1974 (Deahl 2016), a historical fiction about the first dinosaur craze, the nineteenth-century 'Bone Wars' (Rieppel 2019).

Jurassic Park was revolutionary in terms of its impact on ideas about how actual and even heterodox science could be part of the Hollywood mainstream. It established how dinosaurs *should* look on-screen whilst promoting and upholding narratives of evolutionary science and emergent and controversial palaeontological and DNA research. The later *Jurassic World* movies are part of the remake and revival cycle we are experiencing in Hollywood but they have a legacy that is hard to shake and disrupt (Loock 2020). Spielberg's original *Jurassic Park* remains influential not only in its continuing receivership but also in the preservation of drab and featherless dinosaurs (Marshall 2013). The original rejection of realism by the filmmakers, thus cherry-picking from the research of Bakker and others, made these animals more intimidating and impressive on-screen as adversaries and technical achievements. They also showed that, once accepted into the public imagination, it can be difficult to revise or even erase iconic images and discourses of science.

Friends too remains a cultural icon. Wildly popular in the 1990s as 'populist mass entertainment and prescient pop escapism' (Sternbergh 2016), its introduction to Netflix's streaming service in 2015 introduced the show to younger Millennials and Gen Z. While some plot points and jokes have aged poorly, particularly in regard to race and LGBTQ representation (Cobb 2018), the generally sunny and relatable storylines continue to strike a chord (Sanders 2019). On Netflix, it remained one of the service's most popular offerings through the end of 2019, when it decamped to HBOMax in 2020. In 2021, HBOMax aired a reunion special of *Friends,* which was both highly acclaimed and widely watched. Yet, unlike *Jurassic Park,* the focus on *Friends* was never on dinosaurs, to the chagrin of Ross, who 'can't get enough dinosaurs' ('The One With Christmas in Tulsa'). Since the audience never got more than a general sense of Ross's position in many palaeontological debates until, in the case of mass extinction, fairly near its resolution, the reunion special did not have to check in with how he feels about feathered dinosaurs. Ross's most dated position as an academic comes not from a controversial stance on a palaeontological issue, but the fact that he openly dates an undergraduate student in season six.

The Millennials watching *Friends* now – who did not watch it when it first aired, or were not the target audience – are the same generation who grew up watching 1990s dinosaur programming for children. And with the proliferation of other TV shows about scientists such as *Bones* (2005–2017) or *The Big Bang Theory* (2007–2017), Ross's job is now a cool one, and, compared to many of these other science characters, Ross is well-adjusted, socially apt, and conventionally attractive. So, while Ross may be the most recognisable pretend palaeontologist, he is not recognisably a palaeontologist in the ways that Dr Grant and Dr Sattler continue to be. As such, Ross is a heterodox figure in the popular culture landscape: a scientist for whom science is not his key identity. Further, those who lived through the dinosaur renaissance did not necessarily know they were doing so. Dinomania was just another cultural touchstone of their childhoods. Ross's connections to palaeontology become just another part of the 'great times' of the 1990s, to which fans nostalgically cling, as opposed to the 'grittier' world of today (Sternbergh 2016). Ross has none of the stresses and cares that come from typical academic life (Ewen 2018), even as he was living through some of the most hotly contested eras of palaeontology. In fact, the

regular references to real debates in palaeontology made Ross believable, but the general superficiality with which these topics were addressed suggests that, just like Ross's friends, the writers were not terribly interested in the details of Ross's career; the show's whole point was that one's relationship to your friends was of ultimate importance.

Dinomania and the 'dinosaur renaissance' placed popular culture and ongoing palaeontological debates in conversation. *Jurassic Park* and *Friends* are almost polar opposites in this regard: one is based entirely around revolutionary new science, and the other relegates new science to the background. Our discussions of the book and film versions of *Jurassic Park* show the ways in which scientific advances could affect, and be communicated through, popular media. In the contrasting case of cultural behemoths like *Friends*, real world debates about ongoing academic research and the instability of 'established knowledge' can become embedded in the day-to-day, or rather show-to-show.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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